Claims

[c1]   What is claimed is:

1. A method for detecting a black frame of a video signal comprising:

receiving a frame data from the video signal; the frame data comprising a plurality of pixel data each corresponding to a pixel of an image;

processing a setting step for setting a pattern comprising a plurality of reference positions;

processing a sampling step for determining reference pixels according to positions of the pixels in the image; a pixel of the image is determined as a reference pixel if the position of the pixel equals a reference position; the pattern limiting the number of reference pixels to be smaller than the number of pixels of the image, and keeping the number of reference pixels from changing as the pixel data corresponding to the pixels of the image change; and

processing a decision step for determining whether the pixel data corresponding to the pixels of the image fit a default according to the pixel data corresponding to the reference pixels.

[c2]   2. The method of claim 1 wherein the decision step comprises:

determining a mean and a deviation according to the pixel data corresponding to the reference pixels, the mean being an average of the pixel data corresponding to the reference pixels, the deviation being a difference between the pixel data corresponding to a reference pixel and the mean; and

determining whether the pixel data corresponding to pixels of the frame fit the default according to the mean and the deviation.

[c3]   3. The method of claim 1 or claim 2 wherein the default is a data range for a pixel of the image to appear at low brightness.

[c4]   4. The method of claim 2 wherein the deviation is determined according to an absolute value between the pixel data corresponding to each reference pixel and the mean.

[c5]   5. The method of claim 2 wherein when processing the decision step, if the mean is smaller than a threshold mean and the deviation is smaller than a threshold deviation, the pixel data corresponding to the pixels of the image are determined to fit the default.

[c6]   6. The method of claim 1 wherein the image comprises a plurality of pixels arranged in a matrix; the sampling step determining the plurality of reference pixels along the diagonal of the matrix.

[c7]   7. The method of claim 1 wherein the image comprises a plurality of pixels arranged in a matrix; the sampling step determining the plurality of reference pixels along a column or a row of the matrix.

[c8]   8. The method of claim 1 wherein the image comprises a plurality of pixels arranged in a matrix; the sampling step determining the plurality of reference pixels with a plurality of sub-matrixes of the matrix, the number of pixels of each sub-matrix is smaller than the number of pixels of the matrix.

[c9]   9. The method of claim 1 further comprising:
after processing the decision step, processing a second sampling step for determining a plurality of second reference pixels from the pixels of the image if the pixel data corresponding to the pixels of the image do not fit the default; and
processing a second decision step for determining whether the pixel data corresponding to the pixels of the image fit the default according to the plurality of pixel data corresponding to the second reference pixels.

[c10]   10. The method of claim 9 wherein the number of second reference pixels is greater than the number of first reference pixels.

[c11]   11. A method for detecting a black frame of a video signal, the video signal comprising a plurality of frame data in the frequency domain, the method comprising: receiving the frame data in the frequency domain from the video signal; the frame data in the frequency domain corresponding to an image, the image comprising a plurality of blocks each comprising a plurality of pixels comprising corresponding pixel data; wherein the frame data in the frequency domain comprises a plurality of low-frequency data each corresponding to a block of the image;
processing a setting step for setting a pattern comprising a plurality of reference positions;
processing a sampling step for determining reference blocks according to positions of the blocks in the image; a block of the image is determined as a reference block if the position of the block equals a reference position; the pattern limiting the number of reference blocks to be smaller than the number of pixels of the image; and
processing a decision step for determining whether the pixel data corresponding to the pixels of the image fit a default according to the low-frequency data correspond-

ing to the reference blocks.

[c12]   12. The method of claim 11 wherein the decision step comprises:

determining a mean and a deviation according to the low-frequency data corresponding to the reference blocks, the mean being an average of the low-frequency data corresponding to the reference blocks, the deviation being a difference between the low-frequency data corresponding to a reference block and the mean; and determining whether the pixel data corresponding to pixels of the frame fit the default according to the mean and the deviation.

[c13]   13. The method of claim 11 or claim 12 wherein the default is a data range for a pixel of the image to appear at low brightness.

[c14]   14. The method of claim 12 wherein the deviation is determined according to an absolute value between the low-frequency data corresponding to each reference block and the mean.

[c15]   15. The method of claim 12 wherein when processing the decision step, if the mean is smaller than a threshold mean and the deviation is smaller than a threshold deviation, the pixel data corresponding to the pixels of the

image are determined to fit the default.

[c16] 16. The method of claim 11 wherein the image comprises a plurality of blocks arranging in a matrix; the sampling step determining the plurality of reference blocks along the diagonal of the matrix.

[c17] 17. The method of claim 11 wherein the image comprises a plurality of blocks arranging in a matrix; the sampling step determining the plurality of the reference blocks along a column or a row of the matrix.

[c18] 18. A processing circuit for detecting a black frame of a video signal, the video signal comprising a plurality of frame data, the processing circuit comprising:
a receiver for receiving a frame data from the video signal; the frame data comprising a plurality of pixel data each corresponding to a pixel of an image;
a setting module for setting a pattern, the pattern comprising a plurality of reference positions;
a sampling module for determining reference pixels according to positions of the pixels in the image; a pixel of the image is determined as a reference pixel if the position of the pixel equals a reference position; the pattern limiting the number of reference pixels to be smaller than the number of pixels of the image, keeping the number of reference pixels from changing as the pixel

data corresponding to the pixels of the image change; and

a decision module for determining whether the pixel data corresponding to the pixels of the image fit a default according to the pixel data corresponding to the reference pixels.

[c19]   19. The processing circuit of claim 18 wherein the decision module comprises:

a mean decision module for determining a mean according to the pixel data corresponding to the reference pixels, the mean being an average of the pixel data corresponding to the reference pixels; and

a deviation decision module for determining a deviation according to the pixel data corresponding to the reference pixels, the deviation being a difference between the pixel data corresponding to a reference pixel and the mean; and

wherein the decision module determines whether the pixel data corresponding to pixels of the frame fit the default according to the mean and the deviation.

[c20]   20. The processing circuit of claim 18 or claim 19 wherein the default is a data range for a pixel of the image to appear at low brightness.

[c21]   21. The processing circuit of claim 19 wherein the devia-

tion decision module determines the deviation according to an absolute value between the pixel data corresponding to each reference pixel and the mean.

[c22]   22. The processing circuit of claim 19 wherein if the mean is smaller than a threshold mean and the deviation is smaller than a threshold deviation, the decision module determines that the pixel data corresponding to the pixels of the image fits the default.

[c23]   23. The processing circuit of claim 18 wherein the image comprises a plurality of pixels arranged in a matrix; the sampling module determining the plurality of reference pixels along the diagonal of the matrix.

[c24]   24. The processing circuit of claim 18 wherein the image comprises a plurality of pixels arranged in a matrix; the sampling module determining the plurality of reference pixels along a column or a row of the matrix.

[c25]   25. The processing circuit of claim 18 wherein the image comprises a plurality of pixels arranged in a matrix; the sampling module determining the plurality of reference pixels with a plurality of sub-matrixes of the matrix, the number of pixels of each sub-matrix is smaller than the number of pixels of the matrix.

[c26]   26. The processing circuit of claim 18 wherein if the

pixel data corresponding to the pixels of the image do not fit the default, the decision module determines a plurality of second reference pixels from the pixels of the image; the decision module determining whether the pixel data corresponding to the pixels of the image fit the default according to the plurality of the pixel data corresponding to the second reference pixels.

[c27] 27. The processing circuit of claim 26 wherein the number of second reference pixels is greater than the number of first reference pixels.

[c28] 28. A processing circuit for detecting a black frame of a video signal, the video signal comprising a plurality of frame data in the frequency domain, the processing circuit comprising:
a receiver for receiving a frame data in the frequency domain from the video signal; the image comprising a plurality of blocks each comprising a plurality of pixels comprising corresponding pixel data; wherein the frame data in the frequency domain comprises a plurality of low-frequency data each corresponding to a block of the image;
a setting module for setting a pattern, the pattern comprising a plurality of reference positions;
a sampling module for determining reference blocks according to positions of the blocks in the image; a block

of the image is determined as a reference block if the position of the block equals a reference position; the pattern limiting the number of reference blocks to be smaller than the number of pixels of the image; and

a decision module for determining whether the pixel data corresponding to the pixels of the image fit a default according to the low-frequency data corresponding to the reference blocks.

[c29] 29. The processing circuit of claim 28 wherein the default is a data range for a pixel of the image to appear at low brightness.

[c30] 30. The processing circuit of claim 28 wherein the decision module comprises:

a mean decision module for determining a mean according to the low-frequency data corresponding to the reference blocks, the mean being an average of the low-frequency data corresponding to the reference blocks; and

a deviation decision module for determining a deviation according to the low-frequency data corresponding to the reference blocks, the deviation being a difference between the low-frequency data corresponding to a reference block and the mean; wherein the decision module determines whether the pixel data corresponding to pixels of the frame fit the default according to the mean

and the deviation.

[c31]   31. The processing circuit of claim 30 wherein the default is a data range for a pixel of the image to appear at low brightness.

[c32]   32. The processing circuit of claim 30 wherein the deviation decision module determines the deviation according to an absolute value between the low-frequency data corresponding to each reference block and the mean.

[c33]   33. The processing circuit of claim 30 wherein if the mean is smaller than a threshold mean and the deviation is smaller than a threshold deviation, the decision module determines that the pixel data corresponding to the pixels of the image fits the default.

[c34]   34. The processing circuit of claim 28 wherein the image comprises a plurality of blocks arranged in a matrix; the sampling module determining the plurality of the reference blocks along the diagonal of the matrix.

[c35]   35. The processing circuit of claim 28 wherein the image comprises a plurality of blocks arranged in a matrix; the sampling module determining the plurality of the reference blocks along a column or a row of the matrix.